7.19 DEPLETION ANALYSIS

Future depletions of water from the Missouri River basin are going to affect the amount of water that is available to move through the Mainstem Reservoir System. This, in turn, will have an effect on the availability of water needed to meet the various project purposes and will affect the benefits that are provided by the economic uses and environmental resources dependent upon the Mainstem Reservoir System lake levels and releases. This section of the RDEIS presents a brief description of how the depletion analysis was conducted and describes the changes in the use and resource values computed by the economic impacts model, the environmental impacts model, and the Mississippi River navigation model.

The first step in conducting the depletion analysis was to complete the Daily Routing Model (DRM) simulation runs for the alternatives selected for analysis. Three alternatives were selected for this analysis—the CWCP, the GP1528 option, and the GP2021 option. Five levels of depletions were run through the DRM—the current level of depletion (data in previous sections of Chapter 7 of this RDEIS), and 0.8 MAF, 1.6 MAF, 2.4 MAF, and 3.2 MAF of additional depletions. The analyses on these runs will have five data points, one for each level of depletion. The DRM depletion input file was adjusted for each run with all of the water taken from the inflows within the system (versus downstream from the system from tributaries to the Lower River). Figure 7.19-1 shows the average annual release from Gavins Point Dam over the 100-year period of analysis. The analysis demonstrates that an equal amount of water was removed upstream from Gavins Point Dam for each model run, as this plot is a linear plot. The values for each alternative are not identical because evaporation from the lakes will be slightly different for each alternative.

The DRM output files were run through the three economic use or environmental resource models to determine the average annual benefits or values provided for each use or resource category. Figures 7.19-2 and 7.19-3 show the depletion plots for the Missouri River navigation model benefits and young fish production index for the CWCP depletion runs. The first plot was selected to show one with a very good linear correlation of the benefits for the five depletion runs—in this case, navigation (Figure 7.19-2). To show the contrast, the young fish production index plot (Figure 7.19-2) was selected to show what a poor correlation of the data looks like. The plots show the slope of the line and the R-squared value, which is a correlation index. The closer the correlation index is to 1.0, the better the correlation. It is important to point out that the Missouri River navigation model benefits used in the depletion analysis assume that navigation will continue to operate on the Missouri River for the GP2021 option. If the assumption under which only sand and gravel mining and movement of waterway materials were to be used in the depletion analysis, there would be no change with future depletion model runs.

The slope of the linear correlation line (change per MAF of depletion) and the R-squared values are listed in Table 7.19-1 for all of the economic use or environmental resource categories on which the three impacts models provided data. Data with very poor correlation coefficients (i.e., R-squared values less than 0.4) are marked with gray shading. For these resources, increasing levels of depletion have unknown effects on use or resource values.

The remaining slope values were then compared for each use or resource category to determine which of the three alternatives had the greatest change per unit of depletion; these values are highlighted as white text on a black background. Next, for each use or resource category, the alternative with the least change per MAF of depletion was surrounded by a border. Because sensitivity assessments are based on a comparison of values, only those resources for which all three alternatives have good correlation coefficients are included in this analysis. This allows a quick scan of the table to see which of the three alternatives is most sensitive to future depletions and which alternative is least sensitive.

It is readily apparent that the CWCP is by far the most sensitive to future depletions. It has the greatest change (steepest positive or negative slope on the depletion plot) in every category left in the analysis except flood control and Mississippi River navigation. The GP2021 option is by far the least sensitive, as it has the least change (flattest slope on the depletion plot) in all but four of the categories remaining in the analysis. It also has only one use, Mississippi River navigation, with the highest value. The GP1528 option is the middle-of-the-road alternative with one highest change value (flood control) and three of the lowest values. Of course, compared to the CWCP, GP1528 is much less sensitive because it has only one highest value, whereas the CWCP has 10 highest values.

Table 7.19-1. Comparison of the depletion effects to the economic use or environmental resources.

		CWCP		GP1528		GP2021	
Resource/Use	**Units**	**Chg/MAF**	**R squared**	**Chg/MAF**	**R squared**	**Chg/MAF**	**R squared**
Flood Control	$millions	**+ 1.74**	0.753	**+ 2.20**	0.981	+ 1.99	0.968
Navigation	$millions	**- 0.41**	0.994	- 0.35	0.971	**- 0.19**	0.919
Hydropower	$millions	**- 16.49**	0.998	**- 13.44**	0.973	- 15.07	0.979
Water Supply	$millions	**- 3.29**	0.991	- 2.74	0.569	**- 1.84**	0.441
Recreation	$millions	**- 1.64**	0.772	- 1.26	0.925	**- 0.84**	0.659
Total NED Economics	$millions	**- 20.09**	0.987	**- 15.59**	0.957	- 15.95	0.930
Young Fish Production	Index	- 0.00	0.024	- 0.01	0.063	- 0.00	0.003
Reservoir Coldwater Habitat	MAF	**- 0.66**	0.976	- 0.53	0.967	**- 0.49**	0.976
River Coldwater Habitat	miles	**- 4.07**	0.991	**- 0.61**	0.763	**- 0.61**	0.546
River Warmwater Habitat	miles	+ 1.93	0.799	+ 0.01	0.0004	- 0.01	0.001
River Fish Physical Habitat	Index	- 0.11	0.613	+ 0.04	0.201	+ 0.01	0.081
Tern and Plover Habitat	acres	**+ 28.8**	0.795	+ 23.9	0.634	**+ 15.0**	0.449
Wetland Habitat	1,000 acres	- 2.03	0.902	- 0.40	0.229	- 0.35	0.083
Riparian Habitat	1,000 acres	**+ 4.24**	0.969	+ 2.25	0.988	**+ 2.10**	0.977
Historic Properties	Index	**+ 236**	0.992	+ 156	0.953	**+ 148**	0.925
Mississippi River Navigation	$millions	**+ 1.06**	1*	+ 9.93	0.929	**+ 10.36**	0.896

* Only one depletion run was made for the CWCP, which makes a two-point plot (0.0- and 1.6-MAF depletions).
Note: For each alternative, the number in the first column indicates the amount of change associated with each additional million acre-feet (MAF) of water depletion; the number in the second column indicates the strength of that correlation.
Data with very poor correlation coefficients are marked with gray shading. For each resource/use, the alternative with the greatest change per MAF is shown as white on black background, and the alternative with the least sensitivity is surrounded by a border.

Another conclusion can be drawn from the total NED economics (Missouri River only) data in Table 7.19-1. The value of 1 MAF of water in the system is about $20.1 million per year for the CWCP. This value drops to $15.6 million per year for the GP1528 option. The value is slightly higher for the GP2021 option, at about $16.0 million per year. The greatest share of this value comes from the hydropower benefits.

With regard to the three endangered species, future depletion of water from the Mainstem Lake System is good for the terns and plovers (a general gain of 15 to 29 acres of habitat on an annual basis). Future depletion effects are unknown for the pallid sturgeon, because the correlation of the data was generally poor. In the case of the CWCP, the index value dropped a very small 0.11 unit per MAF of depletion, which is 0.1 percent of the average annual value, or essentially no change in value. The other two alternatives had even smaller changes. They, too, had very poor correlation of data for the physical habitat for the native river fish index.

Depletions are generally good for flood control, tern and plover habitat, riparian habitat, and historic properties index. Conversely, depletions are generally bad for navigation, hydropower, water supply, recreation, total NED economics, reservoir coldwater habitat, and river coldwater habitat. All of these general relationships are expected changes based upon less water available in the system for year-to-year operation.

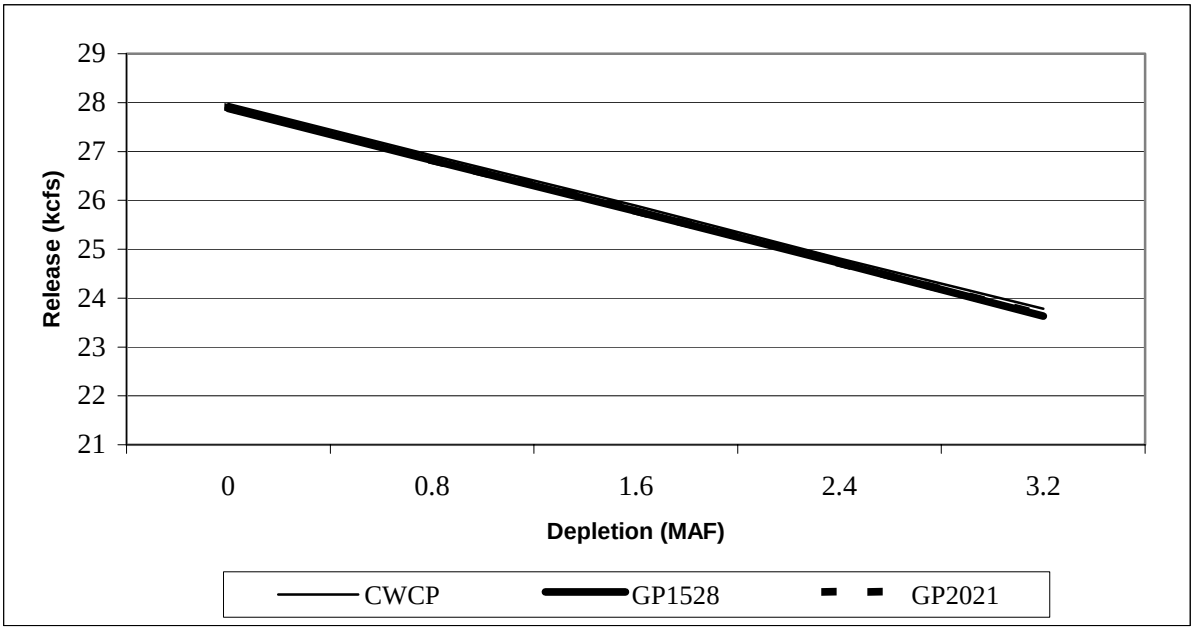

Figure 7.19-1. Average annual release from Gavins Point Dam at different levels of depletion.

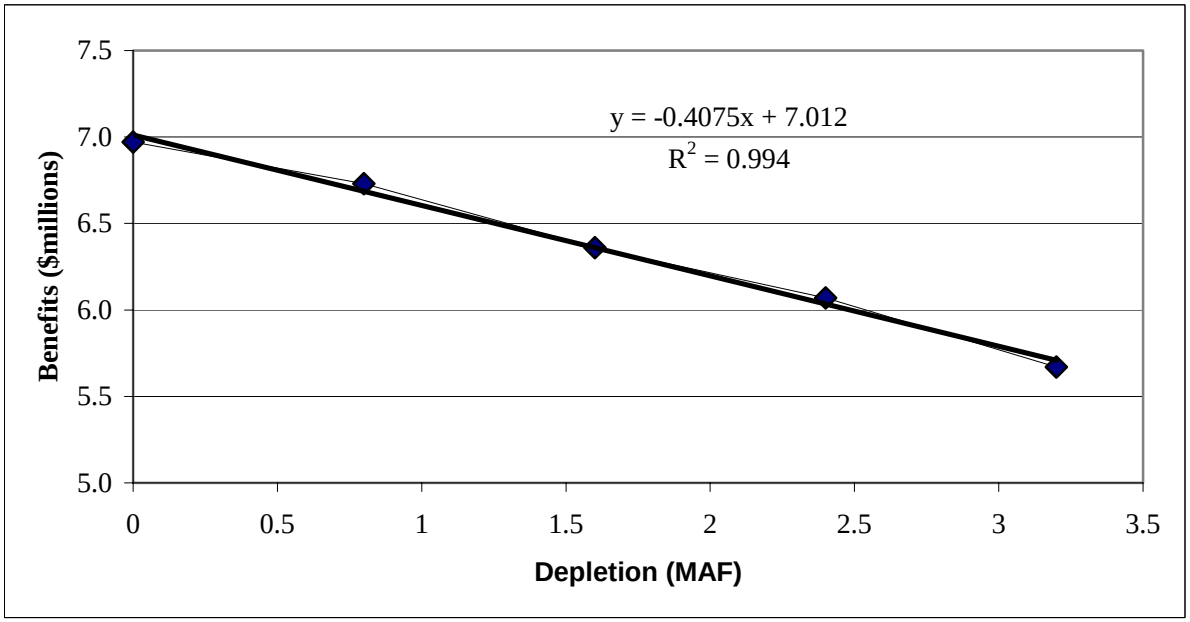

Figure 7.19-2. DRM depletion run results for Missouri River navigation for the CWCP.

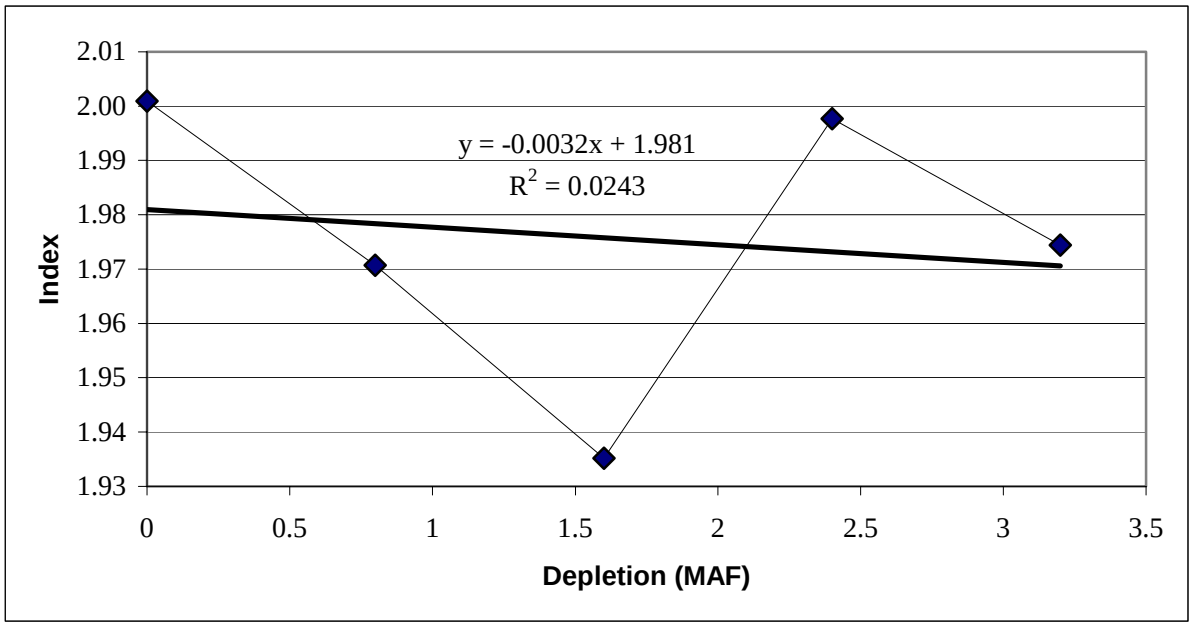

Figure 7.19-3. DRM depletion run results for young fish production for the CWCP.